

IN THE CLAIMS

The following is a complete listing of the claims and replaces all earlier listings and all earlier versions.

1. -18. (Canceled).

6 19. (Currently Amended) An ~~image~~ image data processing apparatus that changes a dynamic range of an original ~~image~~ image data, comprising:

a gradation conversion unit adapted to perform a gradation conversion on the original ~~image~~ image data, based on a gradation conversion curve;

a high-frequency-component generation unit adapted to generate a high-frequency component of the original ~~image~~ image data or an ~~image~~ image data obtained from the gradation conversion performed on the original ~~image~~ image data by said gradation conversion unit;

a conversion unit adapted to convert a magnitude of an amplitude of the high-frequency component; and

a control unit adapted to control an addition of the high-frequency component converted by said conversion unit, after performance of the gradation conversion on the original ~~image~~ image data by said gradation conversion unit,

wherein said conversion unit converts the magnitude of the amplitude of the high-frequency component, based on information concerning an inclination of the gradation conversion curve.

20. (Currently Amended) An apparatus according to Claim 19, wherein said conversion unit converts the magnitude of the amplitude of the high-frequency component, based on the information concerning the inclination of the gradation conversion curve and a pixel value obtained based on the original ~~image~~ image data.

61 21. (Previously Presented) An apparatus according to Claim 19, wherein said conversion unit converts the magnitude of the amplitude of the high-frequency component, based on a differential value of the gradation conversion curve.

22. (Previously Presented) An apparatus according to Claim 19, further comprising an input unit adapted to input a variable for changing a form of the gradation conversion curve.

23. (Currently Amended) An apparatus according to Claim 19, wherein said high-frequency-component generation unit generates a smoothened ~~image~~ image data of the original ~~image~~ image data, and generates the high-frequency component by subtracting the smoothened ~~image~~ image data from the original ~~image~~ image data.

24. (Currently Amended) An apparatus according to Claim 19, wherein said high-frequency-component generation unit generates a smoothened ~~image~~ image data of the original ~~image~~ image data after the gradation conversion, and generates the high-

frequency component by subtracting the smoothened image image data from the original image image data after the gradation conversion.

25. (Currently Amended) An apparatus according to Claim 24, wherein the smoothened image image data is formed by using a morphological filter.

26. (Currently Amended) An apparatus according to Claim 19, wherein said gradation conversion unit converts a form of the gradation conversion curve, based on a feature amount calculated based on the original image image data.

27. (Currently Amended) An image image data processing apparatus comprising:

a smoothening unit adapted to obtain a smoothened image image data from an original image image data;

a high-frequency-component generation unit adapted to generate, as a high-frequency component, a difference between the smoothened image image data obtained by said smoothening unit and the original image image data;

a gradation conversion unit adapted to convert a gradation of the original image image data by using a gradation conversion curve;

a second smoothening unit adapted to obtain a second smoothened image image data from an image image data obtained from the gradation conversion performed by said gradation conversion unit; and

a high-frequency-component addition unit adapted to add the high-frequency component to the second smoothed image image data.

28. (Currently Amended) An apparatus according to Claim 27, wherein said high-frequency-component addition unit changes an amplitude of the high-frequency component, based on a pixel value obtained based on the original image image data, and adds the high-frequency component whose amplitude has been changed to the second smoothed image image data.

29. and 30. (Canceled).

31. (Currently Amended) An image image data processing apparatus comprising:

a smoothing unit adapted to obtain a smoothed image image data from an original image image data;

a high-frequency-component generation unit adapted to generate, as a high-frequency component, a difference between the smoothed image image data obtained by said smoothing unit and the original image image data;

a gradation conversion unit adapted to convert a gradation of the original image image data by using a gradation conversion curve;

a conversion unit adapted to convert a magnitude of an amplitude of the high-frequency component, based on a value concerning an inclination of the gradation conversion curve; and

a high-frequency-component addition unit adapted to add the high-frequency component whose magnitude of the amplitude has been changed by said conversion unit to the ~~image~~ image data whose gradation has been converted.

61 32. (Currently Amended) An apparatus according to Claim 31, wherein said conversion unit converts the magnitude of the amplitude of the high-frequency component, based on information concerning the inclination of the gradation conversion curve and a pixel value obtained based on the original ~~image~~ image data.

33. (Currently Amended) An ~~image~~ image data processing apparatus comprising:

a gradation conversion unit adapted to obtain a converted ~~image~~ image data by converting a gradation of an original ~~image~~ image data;

a smoothening unit adapted to obtain a smoothened ~~image~~ image data by smoothening the converted ~~image~~ image data;

a high-frequency-component generation unit adapted to obtain, as a high-frequency component, a difference between the smoothened ~~image~~ image data and the converted ~~image~~ image data;

a conversion unit adapted to convert a magnitude of an amplitude of the high-frequency component, based on a value concerning an inclination of a gradation conversion curve; and

a high-frequency-component addition unit adapted to add the high-frequency component whose magnitude of the amplitude has been converted by said conversion unit to the converted ~~image~~ image data.

61 34. (Currently Amended) An apparatus according to Claim 33, wherein said conversion unit converts the magnitude of the amplitude of the high-frequency component, based on information concerning the inclination of the gradation conversion curve and a pixel value obtained based on the original ~~image~~ image data.

35. and 36. (Canceled).

37. (Currently Amended) An ~~image~~ image data processing method comprising:

a high-frequency-component conversion step[[,]] of converting an amplitude of a high-frequency component of an ~~image~~ image data, based on information concerning an inclination of a gradation conversion curve; and

an addition step[[,]] of adding the high-frequency component, converted in said high-frequency-component conversion step, to an arbitrary ~~image~~ image data.

38. (Currently Amended) An apparatus according to Claim 23, wherein the smoothened ~~image~~ image data is formed by using a morphological filter.

39. (Currently Amended) An ~~image~~ image data processing method for changing a dynamic range of an original ~~image~~ image data, comprising:

a gradation conversion step[[,]] of performing a gradation conversion on the original ~~image~~ image data, based on a gradation conversion curve;

a high-frequency-component generation step[[,]] of generating a high-frequency component of the original ~~image~~ image data or an ~~image~~ image data obtained from the gradation conversion performed on the original ~~image~~ image data in said gradation conversion step;

a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component; and

a control step[[,]] of controlling an addition of the high-frequency component converted in said conversion step, after performance of the gradation conversion on the original ~~image~~ image data in said gradation conversion step,

wherein said conversion step includes converting the amplitude of the high-frequency component, based on information concerning an inclination of the gradation conversion curve.

40. (Currently Amended) An ~~image~~ image data processing method comprising:

a smoothing step[[,]] of obtaining a smoothed image image data from an original image image data;

a high-frequency-component generation step[[,]] of generating, as a high-frequency component, a difference between the smoothed image image data obtained in said smoothing step and the original image image data;

a gradation conversion step[[,]] of converting a gradation of the original image image data by using a gradation conversion curve;

C 41. a second smoothing step[[,]] of obtaining a second smoothed image image data from an image image data obtained from the gradation conversion performed in said gradation conversion step; and

a high-frequency-component addition step[[,]] of adding the high-frequency component to the second smoothed image image data.

41. (Canceled).

42. (Currently Amended) An image image data processing method comprising:

a smoothing step[[,]] of obtaining a smoothed image image data from an original image image data;

a high-frequency component generation step[[,]] of generating, as a high-frequency component, a difference between the smoothed image image data obtained in said smoothing step and the original image image data;

a gradation conversion step[[,]] of converting a gradation of the original ~~image~~ image data by using a gradation conversion curve;

a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component, based on a value concerning an inclination of the gradation conversion curve; and

a high-frequency-component addition step[[,]] of adding the high-frequency component whose magnitude of the amplitude has been changed in said conversion step to the ~~image~~ image data whose gradation has been converted.

61 43. (Currently Amended) An ~~image~~ image data processing method comprising:

a gradation conversion step[[,]] of obtaining a converted ~~image~~ image data by converting a gradation of an original ~~image~~ image data;

a smoothening step[[,]] of obtaining a smoothened ~~image~~ image data by smoothening the converted ~~image~~ image data;

a high-frequency-component generation step[[,]] of obtaining, as a high-frequency component, a difference between the smoothened ~~image~~ image data and the converted ~~image~~ image data;

a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component, based on a value concerning an inclination of a gradation conversion curve; and

a high-frequency-component addition step[[,]] of adding the high-frequency component whose magnitude of the amplitude has been converted in said conversion step to the converted ~~image~~ image data.

44. (Currently Amended) A program product embodying a program for executing an ~~image~~ image data processing method for changing a dynamic range of an original ~~image~~ image data, the method comprising:

a gradation conversion step[[,]] of performing a gradation conversion on the original ~~image~~ image data, based on a gradation conversion curve;

6. a high-frequency-component generation step[[,]] of generating a high-frequency component of the original ~~image~~ image data or an ~~image~~ image data obtained from the gradation conversion performed on the original ~~image~~ image data in said gradation conversion step;

a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component; and

a control step[[,]] of controlling an addition of the high-frequency component converted in said conversion step, after performance of the gradation conversion on the original ~~image~~ image data in said gradation conversion step,

wherein said conversion step includes converting the magnitude of the amplitude of the high-frequency component, based on information concerning an inclination of the gradation conversion curve.

45. (Currently Amended) A program product embodying a program for executing an image image data processing method, the method comprising:

a smoothening step[[,]] of obtaining a smoothened image image data from an original image image data;

a high-frequency-component generation step[[,]] of generating, as a high-frequency component, a difference between the smoothened image image data obtained in said smoothening step and the original image image data;

a gradation conversion step[[,]] of converting a gradation of the original image image data by using a gradation conversion curve;

CA a second smoothening step[[,]] of obtaining a second smoothened image image data from an image image data obtained from the gradation conversion performed in said gradation conversion step; and

a high-frequency-component addition step[[,]] of adding the high-frequency component to the second smoothened image image data.

46. (Canceled).

47. (Currently Amended) A program product embodying a program for executing an image image data processing method, the method comprising:

a smoothening step[[,]] of obtaining a smoothened image image data from an original image image data;

a high-frequency-component generation step[[,]] of generating, as a high-frequency component, a difference between the smoothened image image data obtained in said smoothening step and the original image image data;

a gradation conversion step[[,]] of converting a gradation of the original image image data by using a gradation conversion curve;

a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component, based on a value concerning an inclination of the gradation conversion curve; and

a high-frequency-component addition step[[,]] of adding the high-frequency component whose magnitude of the amplitude has been changed in said conversion step to the image image data whose gradation has been converted.

48. (Currently Amended) A program product embodying a program for executing an image image data processing method, the method comprising:

a gradation conversion step[[,]] of obtaining a converted image image data by converting a gradation of an original image image data;

a smoothening step[[,]] of obtaining a smoothened image image data by smoothening the converted image image data;

a high-frequency-component generation step[[,]] of obtaining, as a high-frequency component, a difference between the smoothened image image data and the converted image image data;

a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component, based on a value concerning an inclination of a gradation conversion curve; and

a high-frequency-component addition step[[,]] of adding the high-frequency component whose magnitude of the amplitude has been converted in said conversion step to the converted ~~image~~ image data.

49. (Currently Amended) A storage medium storing a program for executing an ~~image~~ image data processing method for changing a dynamic range of an original ~~image~~ image data, the method comprising:

6. a gradation conversion step[[,]] of performing a gradation conversion on the ~~image~~ image data, based on a gradation conversion curve;

a high-frequency-component generation step[[,]] of generating a high-frequency component of the original ~~image~~ image data or an ~~image~~ image data obtained from the gradation conversion performed on the original ~~image~~ image data in said gradation conversion step;

a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component; and

a control step[[,]] of controlling an addition of the high-frequency component converted in said conversion step, after performance of the gradation conversion on the original ~~image~~ image data in said gradation conversion step,

wherein said conversion step includes converting the magnitude of the amplitude of the high-frequency component, based on information concerning an inclination of the gradation conversion curve.

50. (Currently Amended) A storage medium storing a program for executing an ~~image~~ image data processing method, the method comprising:

a smoothing step[[,]] of obtaining a smoothed ~~image~~ image data from an original ~~image~~ image data;

(A) a high-frequency-component generation step[[,]] of generating, as a high-frequency component, a difference between the smoothed ~~image~~ image data obtained in said smoothing step and the original ~~image~~ image data;

a gradation conversion step[[,]] of converting a gradation of the original ~~image~~ image data by using a gradation conversion curve;

a second smoothing step[[,]] of obtaining a second smoothed ~~image~~ image data from an ~~image~~ image data obtained from the gradation conversion performed in said gradation conversion step; and

a high-frequency-component addition step[[,]] of adding the high-frequency component to the second smoothed ~~image~~ image data.

51. (Canceled).

52. (Currently Amended) A storage medium storing a program for executing an image image data processing method, the method comprising:

a smoothening step[[,]] of obtaining a smoothened image image data from an original image image data;

a high-frequency-component generation step[[,]] of generating, as a high-frequency component, a difference between the smoothened image image data obtained in said smoothening step and the original image image data;

a gradation conversion step[[,]] of converting a gradation of the original image image data by using a gradation conversion curve;

6 a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component, based on a value concerning an inclination of the gradation conversion curve; and

a high-frequency-component addition step[[,]] of adding the high-frequency component whose magnitude of the amplitude has been changed in said conversion step to the image image data whose gradation has been converted.

53. (Currently Amended) A storage medium storing a program for executing an image image data processing method, the method comprising:

a gradation conversion step[[,]] of obtaining a converted image image data by converting a gradation of an original image image data;

a smoothening step[[,]] of obtaining a smoothened image image data by smoothening the converted image image data;

a high-frequency-component generation step[[,]] of obtaining, as a high-frequency component, a difference between the smoothened ~~image~~ image data and the converted ~~image~~ image data;

a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component, based on a value concerning an inclination of a gradation conversion curve; and

a high-frequency-component addition step[[,]] of adding the high-frequency component whose magnitude of the amplitude has been converted in said conversion step to the converted ~~image~~ image data.

54. (Currently Amended) An apparatus according to Claim 19, further comprising:

radiation generation means for irradiating radiation rays onto an object; and

a two-dimensional X-ray sensor for converting radiation rays transmitted through the object into an ~~image~~ image data,

wherein the ~~image~~ image data obtained by said two-dimensional X-ray sensor serves as the original ~~image~~ image data.

55. (Currently Amended) An ~~image~~ image data processing apparatus comprising:

storage means for storing information concerning a gradation conversion curve;

high-frequency component generation means for generating a high-frequency component of an ~~image~~ image data, or of an ~~image~~ image data obtained by performing gradation conversion on the ~~image~~ image data[[,]] using the gradation conversion curve;

conversion means for converting a magnitude of an amplitude of the high-frequency component; and

addition means for adding the converted high-frequency component to the ~~image~~ image data, or to the ~~image~~ image data obtained by performing the gradation conversion on the ~~image~~ image data using the gradation conversion curve,

wherein said conversion means converts the amplitude of the high-frequency component on the basis of the information concerning the gradation conversion curve.

56. (Previously Presented) An apparatus according to Claim 55, wherein said conversion means converts the magnitude of the amplitude of the high-frequency component on the basis of the information concerning an inclination of the gradation conversion curve.

57. (Previously Presented) An apparatus according to Claim 55, wherein said conversion means converts the magnitude of the amplitude of the high-frequency component on the basis of a differential value of the gradation conversion curve.

58. (Previously Presented) An apparatus according to Claim 55, further comprising input means for inputting a variable for changing a curve form of the gradation conversion curve.

59. (Currently Amended) An apparatus according to Claim 55, wherein said high-frequency component generation means generates a smoothed ~~image~~ image data from the ~~image~~ image data and subtracts the smoothed ~~image~~ image data from the ~~image~~ image data, thereby to generate the high-frequency component.

60. (Currently Amended) An apparatus according to Claim 59, wherein the smoothed ~~image~~ image data is formed by using a morphological filter.

61. (Currently Amended) An apparatus according to Claim 55, wherein said high-frequency component generation means generates a smoothed ~~image~~ image data from the ~~image~~ image data after the gradation conversion, and subtracts the smoothed ~~image~~ image data from the ~~image~~ image data after the gradation conversion, thereby to generate the high-frequency component.

62. (Currently Amended) An apparatus according to Claim 61, wherein the smoothed ~~image~~ image data is formed by using a morphological filter.

63. (Currently Amended) An apparatus according to Claim 55, wherein a curve form of the gradation conversion curve is changed according to a feature amount calculated based on the ~~image~~ image data.

64. (Currently Amended) An apparatus according to Claim 55, further comprising:
radiation generation means for irradiating radiation rays onto an object; and
a two-dimensional X-ray sensor for converting the radiation ray transmitted through the object into an ~~image~~ image data,
wherein the ~~image~~ image data obtained by said two-dimensional X-ray sensor serves as the original ~~image~~ image data.

65. (Currently Amended) An ~~image~~ image data processing method comprising:
a storage step[[,]] of storing information concerning a gradation conversion curve;
a high-frequency component generation step[[,]] of generating a high-frequency component of an ~~image~~ image data or an ~~image~~ image data obtained by performing gradation conversion on the ~~image~~ image data[[,]] using the gradation conversion curve;
a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component; and

an addition step[[,]] of adding the converted high-frequency component to the image image data, or to the image image data obtained by performing the gradation conversion on the image image data using the gradation conversion curve,

wherein said conversion step includes converting the amplitude of the high-frequency component on the basis of the information concerning the gradation conversion curve.

66. (Currently Amended) A program for executing an image image data processing method comprising:

a storage step[[,]] of storing information concerning a gradation conversion curve;

(A) a high-frequency component generation step[[,]] of generating a high-frequency component of an image image data or an image image data obtained by performing gradation conversion on the image image data using the gradation conversion curve;

a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component; and

an addition step[[,]] of adding the converted high-frequency component to the image image data, or to the image image data obtained by performing the gradation conversion on the image image data using the gradation conversion curve,

wherein said conversion step includes converting the amplitude of the high-frequency component on the basis of the information concerning the gradation conversion curve.

67. (Currently Amended) A storage medium which stores a program for executing an ~~image~~ image data processing method, said method comprising:

a storage step[[,]] of storing information concerning a gradation conversion curve;

a high-frequency component generation step[[,]] of generating a high-frequency component of an ~~image~~ image data, or of an ~~image~~ image data obtained by performing gradation conversion on the ~~image~~ image data using the gradation conversion curve;

a conversion step[[,]] of converting a magnitude of an amplitude of the high-frequency component; and

an addition step[[,]] of adding the converted high-frequency component to the ~~image~~ image data, or to the ~~image~~ image data obtained by performing the gradation conversion on the ~~image~~ image data using the gradation conversion curve,

wherein said conversion step includes converting the amplitude of the high-frequency component on the basis of the information concerning the gradation conversion curve.

68. (Canceled).

69. (New) An image data processing apparatus comprising:
a high-frequency-component conversion unit adapted to convert an amplitude of a high-frequency component of an image data, based on information concerning an inclination of a gradation conversion curve; and
an addition unit adapted to add the high-frequency-component, converted in said high-frequency-component conversion unit, to an arbitrary image data.

70. (New) An apparatus according to Claim 69, wherein the addition unit adds the converted high-frequency component to the image data or the image obtained by gradation-converting the image data based on the gradation conversion curve.

71. (New) An apparatus according to Claim 69, wherein the high-frequency-component conversion is to change the image data based on the differential value of the gradation conversion curve.

72. (New) A apparatus according to Claim 69, further comprising a gradation conversion unit adapted to gradation-convert the image data based on the gradation conversion curve,

wherein said addition unit adds the converted high-frequency component to the gradation-converted image.

73. (New) An apparatus according to Claim 69, further comprising a

high-frequency component generation unit adapted to generate a smoothed image from the image data and subtract the smoothed image data from the image data, thereby generating the high-frequency component.

74. (New) An apparatus according to Claim 69, further comprising:
an radiation generation unit adapted to irradiate radiation rays onto an object; and
a two-dimensional X-ray sensor adapted to convert the radiation ray transmitted through the object into an image data,
wherein the image obtained by said two-dimensional X-ray sensor serves as the image.

75. (New) A program product embodying a program for executing an image data processing method comprising:
a high-frequency-component conversion step of converting an amplitude of a high-frequency component of an image data, based on information concerning an inclination of a gradation conversion curve; and
an addition step of adding the high-frequency component, converted in said high-frequency-component conversion step, to an arbitrary image data.

76. (New) A storage medium storing a program for executing an image data processing method comprising:

a high-frequency-component conversion step of converting an amplitude of a high-frequency component of an image data, based on information concerning an inclination of a gradation conversion curve; and

61 an addition step of adding the high-frequency component, converted in said high-frequency-component conversion step, to an arbitrary image data.
